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ABSTRACT

This paper examines the discriminative validity of the Learning Efficiency Test II (LET-II; Webster, 1998) in distinguishing among children diagnosed as having ADHD (Attention Deficit Hyperactivity Disorder) only, ADHD and an accompanying learning disability, ADHD-predominantly inactive type, and a control group. Children (N=132) between the ages of 8 and 16 who referred to a private clinic for psychoeducational evaluations participated in the survey. Each of the participants in the attention deficit groups had been previously identified by at least two professionals as having the specific disorder. Participants for the control group were children referred for other reasons such as underachievement, family problems, or emotional concerns. Analysis determined that the LET-II provided an overall discrimination rate of 57.6% in distinguishing among the four groups of learners. In addition, when comparing the simple dichotomy of the combined ADHD groups as being distinguished from the average group, the LET-II correctly identified 78 of 93 total participants, to yield an 83.9% accuracy rate in distinguishing between ADHD and the non-ADHD group. The data suggests that ADHD may be a disorder involving some kind of atypical cognitive processing where the child is unable to access and retrieve information from either short-term and/or long-term memory stores quickly and efficiently. (JDM)

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Attending Patterns of ADHD Children on the Learning Efficiency Test-II.

ADHD has become one of the most widely challenged and contested diagnoses in recent years because of the lack of clarity and objectivity in making the diagnosis. The core symptoms comprising the diagnosis consist of impulsivity, hyperactivity, and inattention.

Proponents of the disorder argue that between 2 and 9.5 percent of school-aged children throughout the world have ADHD (Barkley, 1996). Yet, 90 percent of the Ritalin made in the world is used in the United States and around 12 percent of males between the ages of 6 and 14 years in this country are taking Ritalin (Breggin, 1998). Much of the focus in making this diagnosis seems to address the presented activity levels of the child and much less focus is on the alleged attentional deficits that characterize the disorder. The most typical manner in which the diagnosis is made is reliance on child behavior checklists or rating scales in which reports are made by primary caretakers about the child's performance in a variety of settings, despite research suggesting that these reports can be highly discrepant with reality measures of the child's performance and, consequently, inaccurate (O'Donnell, et al., 1998). Few studies exist demonstrating the utility of an objective psychological test or test battery to identify ADHD children and especially how these children attend and concentrate over a sustained time period.

Phelps (1996) examined the utility of the WRAML, WISC-III, and Woodcock-Johnson Tests of Achievement in differentiating among 40 ADHD, 40 LD, and 40 control group children and found a 72.5% discrimination rate for the three

groups. Only 50% of the ADHD group was correctly classified and distinguished from the average control group using this battery. Performance of ADHD children on continuous performance tasks such as the Gordon CPT tend to produce high rates of both false positives and false negatives (Trammer, Hoeppner, & Armstrong, 1988) when used to differentiate between ADHD and non-ADHD children referred to clinics for treatment. With this as a brief framework, this study examined the discriminative validity of the Learning Efficiency Test - II (LET-II; Webster, 1998) in distinguishing among children diagnosed as having ADHD only, ADHD and an accompanying LD, ADHD - predominantly inattentive type, and a control group.

Methods

Participants

A total of 132 children (104 males and 28 females) between the ages of 8 years, 0 months and 16 years, 0 months (M = 12.57 years, SD = 3.10) who were referred to a private clinic for psychoeducational evaluations participated in this study. The racial distribution within the sample was 86 Caucasians, 45 African-Americans, and 1 Hispanic child. Four groups were identified. The first three groups were children who had been previously identified as having an attention deficit disorder. The first group was comprised of 43 children diagnosed as having ADHD; the second group consisted of 27 children identified as having ADHD and a learning disability based on a 15 point or greater intelligence-achievement significant discrepancy only in reading; and the third group contained 23 children diagnosed as having ADHD, predominantly inattentive type. A fourth group of 39 children who had no reported academic

or behavioral problems at home or school served as the control group. None of the children in this group were receiving, or had ever received, special education services from their school districts. All children were from middle and upper middle SES backgrounds.

Each of the participants in the attention deficit groups had been previously identified by at least two professionals as having the specific disorder noted prior to being tested with the LET-II. Participants for the control group were children referred to the clinic for other reasons such as under - achievement, family problems, or emotional concerns.

Procedures

Each child was individually administered the LET-II by a licensed doctoral level psychologist as part of a comprehensive psychoeducational test battery being given to develop an educational program. The basic psychoeducational test battery consisted of the WISC-III to include all subtests except Mazes, the LET-II, and the Woodcock-Johnson Tests of Achievement. All three tests were administered in a counter-balanced design format. In addition to these tests, information from their teachers was provided about the grade level in reading and mathematics at which each child was functioning.

Statistical Analyses

Basic demographic data were calculated by group for performance on each of the three tests given. These specifically involved the three IQ scales and Verbal Comprehension, Perceptual Organization, and Freedom from Distractibility supplemental scales from the WISC-III; the twelve subtest scores and three factor scales from the LET-II; the three broad subtest scores

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from the Woodcock-Johnson Test; and teacher estimates of the actual grade level of functioning at school in Reading and Mathematics. Table 1 presents a summary of the performance levels on the WISC-III, Woodcock-Johnson Test, and teacher estimates for functioning, while Table 2 provides a performance summary for the LET-II, for each group.

Several discriminant functions analyses were computed using the variables from the LET-II.

Results and Discussion

The first discriminant functions analysis used only the twelve subtests from the LET-II and showed that these subtests had a 57.6% overall correct classification rate across the four groups. Three canonical discriminant functions were identified, accounting for 100% of the variance ($X^2_{[27]}$ = 104.5, p = .000). Further analysis clarified that the Average group could be differentiated from the three ADHD groups with 84.8% accuracy, where 78 of the 92 total children were correctly placed.

A second discriminant functions analysis was done using only the three memory modality factor scores from the LET-II. This analysis showed an overall correct classification rate of 51.5% ($X^2_{[9]}$ = 47.7, p = .000), but a discrimination rate of 59.0% between the average and ADHD groups. Ten (10.7%) of the 93 total students in the 3 ADHD groups were classified as Average based on these 3 factor scores.

A third discriminant analysis involved using all three memory modality factor scores and the twelve subtests from the LET-II. An overall total of 63.4% of the cases were correctly classified into their corresponding group ($X^2_{[45]}$ = 133.9, p = .000), with only five of the average children predicted

(12.8%) to be ADHD on the basis of these data.

Among the three separate discriminant functions analyses nine of the twelve LET-II subtests seemed to be the best set of variables that reliably differentiated between the ADHD and Average groups. These subtests were, in order of entry into the nine level stepwise analysis: AUS, VOI, VOL, VOS, AUI, AUL, AUS, AOI, and VUS. The Average group scored significantly higher than the ADHD groups on each of these subtests, with the exception of VOL where the ADHD group scored significantly higher than the Average group. The Average group scored significantly higher than either the ADHD-I or ADHD-LD groups on this subtest. All between-group differences were significant at or beyond the .05 level, with most significant beyond the .01 level.

Examination of the group means on the twelve subtests shows that a distinct pattern can be identified. The Average group shows a consistent decline in the amount of information recalled from one subtest to the next, reflecting the increasingly negative impact of verbal interference on retrieval and retention. This pattern for information loss is expected. Moreover, the Average group shows a consistently higher level of functioning on each subtest of the LET-II and retains and recalls significantly more information in each of the free recall conditions with and without verbal interference present.

The ADHD groups, though show a remarkable and rather unusual reaction to increasing verbal interference. The ADHD and ADHD-LD groups show a V-pattern on the visual ordered and auditory unordered subtests, in that they actually recall more information in the long-term recall subtest than they do in the short-term subtest. Apparently, they are having difficulty accessing the

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information to be retrieved quickly and require additional time to do so, despite having additional interference presented. The ADHD-I group shows a slightly different subtest performance pattern in that they tend to score significantly lower than either ADHD group on each of the visual subtests, while showing a dramatic decline on the amount of information lost during the auditory ordered long-term subtest. This group also showed an inverted-V pattern of recall in the visual ordered and auditory unordered subtests. This means that these participants actually recalled more information following the presentation of verbal interference than they did when there was no verbal interference presented.

An examination of the individual participants test performance patterns within each of the four groups revealed a remarkable and interesting pattern. Four participants in the Average group showed a V-pattern or inverted-V pattern on at least one modality-specific and order-specific triad of the LET-II subtests. On the other hand, 78 members of the ADHD, ADHD-I, and ADHD-LD groups showed either of these patterns on at least one triad. This analysis suggests that children with an attention disorder seem to have unusual and atypical patterns of processing information in that they need more time to process, organize, store, and retrieve it than their peers who do not show attention problems.

Finally, using only the ADHD groups several correlations were computed between the LET-II scores with the other tests used in this battery. These results are presented in Table 4. Six of the 21 total correlations calculated reached statistical significance, with no correlations exceeding .40 ($p = .000$). These correlations suggest that the LET-II bears some communality with

the WISC-III and the WJ-R in terms of the skills being measured, but there is not a great deal of overlapping measurement. These data indicate that the LET-II is measuring some factor that is related to achievement and intellectual functioning, but is not merely replicating a measurement of these factors as would be indicated by higher correlations.

Conclusions Based on these Data

1. The LET-II shows a satisfactory overall discrimination rate of 57.6% in distinguishing among the four groups of learners. Chance would predict that a 25% group placement accuracy rate would exist.

2. The ADHD, ADHD-I, and ADHD-LD groups seem to be closely related in terms of how the participants process visual and auditory information. Twenty children from the latter two groups had test patterns that were closely similar to those of the ADHD group.

3. When comparing the simple dichotomy of the combined ADHD groups as being distinguished form the Average group, the LET-II correctly identified 78 of 93 total participants. This yields an 83.9% accuracy rate in distinguishing between ADHD and non-ADHD children.

4. Nine of 39 average children were incorrectly identified as having one of the three types of ADHD based on the LET-II, for a 23.1% false positive identification rate.

5. The data suggest that ADHD may be a disorder involving some kind of atypical cognitive processing where the child is unable to access and retrieve information from either short-term and/or long term memory stores quickly and efficiently. Consequently, they show dysregulated behaviors which are not consistent with the immediate realities of the situation because they are

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unable to keep up with the information pace and flow as it evolves, particularly when engaged in social transactions.

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Table 1

Descriptive Statistics for the Four Groups

	ADHD		ADHD-I		ADHD-LD		AVERAGE	
VARIABLE	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Reading	90.4	13.7	88.8	15.2	92.0	25.0	104.2	17.8
Math	89.7	14.1	84.9	15.2	88.7	16.8	104.0	21.5
Writing	86.3	12.2	85.9	11.0	82.4	23.0	97.4	18.7
Verbal IQ	90.4	11.4	88.2	12.7	97.4	18.9	96.0	18.6
Perf IQ	88.8	14.4	87.9	13.1	97.8	11.6	104.2	22.3
FSIQ	88.9	11.8	87.1	13.0	97.3	15.9	103.0	19.0
DSpan	8.9	2.9	8.6	2.9	8.9	2.6	11.0	2.9
VComp	92.1	13.0	89.6	14.2	98.7	18.4	104.2	16.4
POrgn	90.6	15.8	88.7	15.0	99.2	14.0	99.7	20.0
FFD	92.4	14.0	89.0	13.2	93.3	15.5	101.1	21.3
Rdg/GLE	4.3	2.1	4.4	2.2	5.0	2.1	5.3	2.8
Math/GLE	4.6	2.3	4.5	2.1	4.9	2.2	5.6	2.0

Table 2

Descriptive Statistics for the Four Groups on the LET-II

	ADHD		ADHD-I		ADHD-LD		AVERAGE	
Variables	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
Visual	100.4	19.9	85.7	20.2	93.0	21.8	102.3	20.5
Auditory	93.3	17.2	93.8	21.0	91.4	20.6	100.1	21.0
Global	97.3	26.3	88.2	27.3	88.1	31.3	104.5	19.3
VOI	8.5	2.4	7.0	2.2	9.0	2.6	10.3	2.1
VOS	7.0	3.4	7.1	3.8	5.1	4.2	8.3	3.0
VOL	8.6	3.8	6.6	3.6	6.0	4.5	7.2	3.1
VUI	9.3	2.7	8.0	2.5	9.5	2.5	11.9	3.2
VUS	9.0	3.3	7.9	2.9	8.7	3.2	10.7	3.0
VUL	9.1	2.9	8.4	3.1	9.1	2.2	9.8	3.0
AOI	8.6	2.5	8.9	3.1	8.7	2.0	11.4	2.1
AOS	5.9	3.1	7.8	4.2	6.8	4.2	9.2	3.0
AOL	5.8	3.3	5.7	3.3	6.7	4.1	7.7	3.2
AUI	8.9	2.5	9.0	3.1	9.7	2.6	12.5	3.4
AUS	8.0	3.1	9.4	3.2	8.6	3.3	12.0	2.5
AUL	8.6	3.1	8.5	2.4	8.7	3.6	11.1	2.2

Table 3

Correlations for the LET-II with Typical Psychological Tests Used in the Schools

	LET-II Variables		
Tests	**Visual Memory**	**Auditory Memory**	**Global Memory**
Verbal IQ	.20	.26, =.024	.18
Performance IQ	- .06	.06	- .07
Full Scale IQ	.09	.18	.07
Digit Span	.13	.31, p=.008	.20
Woodcock-Johnson Tests			
Reading	.33, p=.004	.40, p=.000	.35, p=.002
Mathematics	.12	.34, p=.003	.17
Written Language	.05	.21	.14
LET-II			
Visual Memory		.32, p=.002	.77, p=.000
Auditory Memory			.78, p=.000

Table 4

Discriminant Functions Analysis Using the LET-II Subtests

	Predicted Group Membership			
Actual Group	**ADHD**	**ADHD-I**	**ADHD-LD**	**Average**
ADHD (N=43)	30	4	5	4
ADHD-I (N=27)	10	11	1	5
ADHD-LD (N=23)	10	2	5	6
Average (N=39)	4	4	1	30

OVERALL CLASSIFICATION RATE:	57.6%
AVERAGE vs. LD DIFFERENTIATION:	84.8% (n=78/92)
AVERAGE CORRECTLY CLASSIFIED:	76.9% (n=30/39)